Claims

1. Process for manufacturing a steel product made of copper-rich carbon steel, wherein:

- a liquid steel is produced, which has the following composition, expressed as percentages by weight:

* $0,0005\% \leq C \leq 1\%$
* $0.5 \leq Cu \leq 10\%$
* $0 \leq Mn \leq 2\%$
* $0 \leq Si \leq 5\%$
* $0 \leq Ti \leq 0.5\%$
* $0 \leq Nb \leq 0.5\%$
* $0 \leq Ni \leq 5\%$
* $0 \leq Al \leq 2\%$

the remainder being iron and impurities resulting from production;

- this liquid steel is cast directly into the form of a thin strip having a thickness less than or equal to 10 mm;

- the strip is cooled rapidly to a temperature less than or equal to 1000°C;

- the thin strip is subjected to hot-rolling at a reduction rate of at least 10%, the end-of-rolling temperature being such that, at this temperature, all the copper is still in a solid solution in the ferrite and/or austenite matrix;

- the strip is subjected to forced cooling so as to keep the copper in a supersaturated solid solution in the ferrite and/or austenite matrix;

- and the strip is coiled.

2. Process according to claim 1, characterised in that the Mn/Si ratio is greater than or equal to 3.

3. Process according to either claim 1 or 2, characterised in that the thin strip is cast on a casting installation between two internally cooled rolls rotating in opposite directions.

4. Process according to any one of claims 1 to 3, characterised in that hot-rolling of the strip is carried out in line with the casting of the strip.

5. Process according to any one of claims 1 to 4, characterised in that the rate V of forced cooling after hot-rolling is such that

$$V \geq e^{1.98(\%Cu)-0.08}$$

wherein V is expressed in °C/s and %Cu in % by weight.

6. Process according to any one of claims 1 to 5, characterised in that the carbon content of the steel is between 0.1 and 1% and in that the strip is coiled at a temperature higher than the temperature M_S at the beginning of martensitic transformation.

7. Process according to any one of claims 1 to 5, characterised in that the strip is coiled at less than 300°C and in that the strip is then subjected to a copper precipitation heat treatment at between 400 and 700°C.

8. Process according to claim 7, characterised in that the carbon content of the steel is between 0.1 and 1% and in that the strip is subjected to precipitation heat treatment without being uncoiled beforehand.

9. Process according to any one of claims 1 to 5, characterised in that coiling of the strip is carried out at a temperature which is both higher than the temperature M_S at which the martensitic transformation begins and lower than 300°C, and is followed by cold-rolling, recrystallisation annealing in a temperature range where the copper is in a supersaturated solid solution, forced cooling to keep the copper in a solid solution and precipitation tempering.

10. Process according to claim 9, characterised in that said precipitation tempering is carried out at between 600 and 700°C in a continuous annealing installation.

11. Process according to claim 9, characterised in that said precipitation tempering is carried out at between 400 and 700°C in a batch annealing installation.

12. Process according to any one of claims 1 to 5, characterised in that coiling of the strip is carried out at a temperature which is both higher than the temperature M_S at which the martensitic transformation begins and lower than 300°C and is followed by cold-rolling and batch annealing at

between 400 and 700°C which acts as both recrystallisation annealing and precipitation tempering.

13. Process according to any one of claims 9 to 12, characterised in that the carbon content of the steel is between 0.1 and 1%.

14. Process according to any one of claims 9 to 12, characterised in that the carbon content of the steel is between 0.01 and 0.2%.

15. Process according to any one of claims 9 to 12, characterised in ~~that the carbon content of the steel is~~ between 0.0005% and 0.05% and in that its copper content is between 0.5 and 1.8%.

16. Process according to claim 15, characterised in that, prior to precipitation hardening, the strip is cut to form a sheet which is shaped by drawing, and in that precipitation tempering is carried out on the drawn sheet.

17. Process according to any one of claims 1 to 15, characterised in that the strip is subjected to a final treatment in a skin-pass rolling mill.

18. Steel product, characterised in that it is obtained by a process according to any one of claims 1 to 17.